Fry. (H. D.)

THE

FUNCTION OF THE COCCYX

IN THE

MECHANISM OF LABOR.

BY

HENRY D. FRY, M.D.,

Washington, D. C.

[Reprinted from the AMERICAN JOURNAL OF OBSTETRICS AND DISEASES OF WOMEN AND CHILDREN, Vol. XXI., December, 1888.]

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It may seem like "carrying coals to Newcastle" to introduce for discussion a subject connected with the mechanism of labor, yet there are many points relating to the phenomena of child-birth which are viewed differently by our most recent obstetric writers.

Little more than half a century ago, the profession were entirely ignorant of the laws governing the expulsion of the fetus through the maternal passages, and the act was as simple to the medical mind of that period as was the extrusion of a blood clot or uterine polypus. Step by step, mysteries were unravelled, and each successive investigator added his quota of knowledge to the stock already acquired; false impressions were corrected, and now the laws governing the phenomena of child-birth form a mechanism which challenges nature to show another more wonderful, or one which more beautifully demonstrates her resources for adapting a means to an end.

In order to impress upon students a mental picture of the various movements imparted to the fetus during the mechanism of its birth, obstetric writers are accustomed to describe five successive steps or stages as *flexion*, *descent*, *rotation*, *extension*, and *external rotation*. Cazeaux, Charpentier, Barnes, and Parvin add a sixth, the expulsion of the body. Playfair likewise makes six stages, describing as his third that of *levelling* or extension of the head in the cavity of the pelvis.

These are not so many separate or distinct acts executed with the precision of well-drilled troops, but they pass imperceptibly from one to another, and often combine two or more movements at the same time. Let us define what we understand by the expression "stage" of the mechanism of labor.

Any distinct movement of the fetus during its passage through

[1] Read before Washington Obstet. and Gyn. Soc. meeting, June 15th, 1888.

the parturient canal may be termed a stage when it has the effect of: 1st, diminishing the diameters of the presenting part, and

2d, bringing the longer diameters of the fetus coincident with the longer diameters of the pelvic canal.

These are the fundamental principles involved. Accidental movements imparted to particular cases in consequence of anomalous conditions, either of the fetus or pelvic canal, are excluded.

The first of these objects (diminution of the diameters of the presenting part), is confined to the movements of the head—the hard and incompressible nature of which demands move ments of flexion and extension in addition to that of rotation. The latter movement is common to all portions of the fetal body, and accomplishes the second object—that of bringing the longer diameters of the fetus coincident with the longer diameters of the canal.

Moreover, flexion and extension are intimately associated with descent, the occiput or bregma descending in conjunction with the respective movements.

Descent of the occiput beneath the pubes is associated with extreme flexion of the head at the pelvic outlet, while extension sweeps the face over the perineum and delivers the head.

These final steps which free the head from the pelvic outlet bring us to the consideration of *the function of the coccyx in the mechanism of labor.*

No function whatever is attributed to this little bone, situated at the extremity of the spinal column, except to get out of the way of the advancing head, and thereby to increase the antero-posterior diameter of the inferior strait. It is not supposed to possess any obstetrical importance unless it rudely refuses to step aside.

Premature ossification of its articular cartilages is mentioned as a source of dystocia, and instances are reported of fracture of the bone.

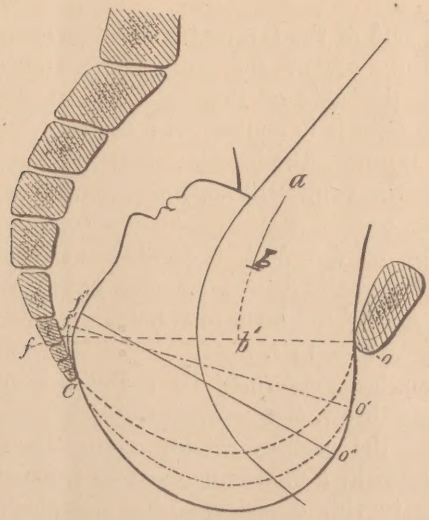
I believe, however, that the coccyx has a distinct function to perform, and only after having performed it, does the bone recede before the advancing brow. To be placed at the pelvic outlet merely as an impediment, without having some office to perform, is contrary to nature's law.

In order to explain this function as I interpret it, the accom-

panying diagram is introduced to represent the movement of extreme flexion at the outlet.

The forces producing flexion and extension of the head are recognized to be the expulsive power of the uterine and voluntary muscles acting upon the fetal ovoid on one hand, and the opposing force or resistance offered by the structures to the passage of the head on the other.

The line *a b* represents a part of the spinal column of the fetus; *o f*, the occipito-frontal diameter of the fetal head; *b'*, a point on this diameter opposite the foramen magnum; *o b'*, the short end of the lever extending from the occiput to a point opposite the articulation of the spinal column; and *f b'*, the



long end of the lever extending from the brow to the same point.

During uterine contraction the head is forced downwards by the power acting in the direction of *a b*. Flexion or extension results according to the amount of resistance offered at the end of one or the other lever, that lever descending which meets least resistance. With equal resistance at both ends, *o* will descend, and flexion occur because *o b'* is the shorter lever. This movement takes place early in labor, and facilitates the passage of the head by substituting a shorter diameter for the occipito-frontal.

In occipito-anterior positions, which we are now considering,

the head passing downwards and backwards reaches the inferior strait in a position of partial flexion. The occiput (*o*) is behind the symphysis, the frontal end (*f*) of the occipito-frontal diameter is in the hollow of the sacrum, and the brow impinges against the coccyx (*c*). Further descent in this direction is prohibited by the coccyx, and the long end of the lever *b' f* is held up by the pressure of the bone against the brow at *c*. In consequence of this increased resistance posteriorly, the force of the uterine contractions is now exerted upon the short or occipital end. The head moves on its transverse axis, the occiput slips down under the symphysis to *o'*, and then, by an exaggeration of the same movement, becomes fixed at *o''*.

The long end of the lever ascends slightly to *f'* and later to *f''*, whilst the body of the fetus being forced down in the direction of the axis of the pelvic canal, the sternum approaches and later is in contact with the chin.

The head is now at the inferior strait *in a position of extreme flexion*, with the brow still kept up by the resistance of the coccyx. The occiput has slipped *downwards and backwards* and the nape of the neck is applied to the symphysis. The sub-occipito-bregmatic diameter engages at the outlet.

The short end of the lever (*o''*) being fixed, motion is transferred to the long end *f''*.

The coccyx has performed its function and recedes before the advancing brow, the perineum distends as the chin leaves the sternum,[1] the occiput rotates around the symphysis, and the head is born by a final movement of extension.

According to this description, *the function of the coccyx is to oppose the descent of the brow, thus forcing down the occipital end of the lever beneath the symphysis; in other words, to produce extreme flexion of the head at the pelvic outlet.*

For several years I have taken advantage of every opportunity to examine the final movements which give birth to the head, and claim to have clearly recognized, in all cases of occipito-anterior positions, this flexion at the inferior strait, and further to attribute it to an arrest of the brow by the coccyx.

The method employed is as follows:

Having taken the precaution to see that the rectum is empty,

[1] Tarnier and Barnes both claim that the chin is applied to the sternum until the bregma is escaping from the vulva.

the patient is placed upon her back with the knees elevated. When the head has descended into the pelvic cavity and is approaching the inferior strait, pass the index-finger of the right hand into the rectum until it comes in contact with the coccyx. Each uterine contraction approximates the head to the finger until finally it is driven forcibly against it. During the interval between the contractions, the finger readily passes between the coccyx and the head, but at each pain the finger is pushed aside, as the bregma is forced against the bone. Now let the thumb of the same hand be inserted between the vulva and behind the symphysis until it comes in contact with the occiput. Both ends of the lever are now placed under observation and the movement of either is readily recognized. The head occupies the following relations to the pelvic outlet:[1] the occiput is behind and slightly to the left of the symphysis, the biparietal suture runs, not in the antero-posterior diameter of the outlet, but crosses it as it passes backwards and to the right. The anterior fontanelle is in the sacral cavity and to the right of the median line. The coccyx comes in contact with the left parietal bone behind the anterior fontanelle and near the biparietal suture. *The bregma does not press forcibly against the perineum. The finger can easily pass between the head and perineum and the latter does not begin to distend until after the occiput is fixed and extension of the head is commencing.*

With the finger and thumb placed as described, it will be noticed that the continuance of uterine action forces the bregma against the coccyx, and as this offers a barrier to its progress, the occiput slips downwards and backwards until the nape of the neck is applied to the symphysis. Extreme flexion has occurred.

This stage is represented by the cut and is that immediately preceding extension. The points I desire particularly to emphasize are that the occiput passes downwards and backwards in the direction of the line *a b*, in order to reach this position, and that the perineum does not yet oppose the bregma.

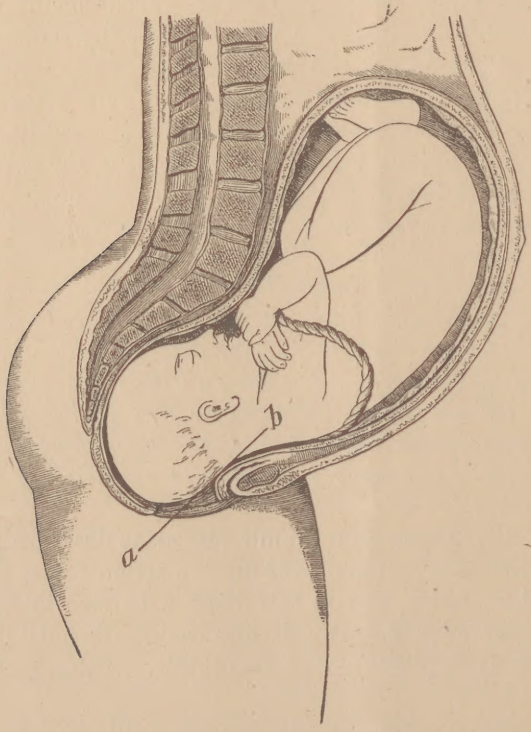
The continuance of uterine action, however, with now the opposing force of the perineal muscles and fixation of the occiput, produces extension, the resistance of the coccyx is

[1] Original position L. O. A.

overcome, and the head is born, the occiput moving forwards and upwards under the symphysis.

This flexion at the inferior strait which I have described as a normal stage of the mechanism of labor is either overlooked by obstetric writers, or if explained at all is done so on different principles.

Charpentier recognizes its existence. He says [1] "it is even the rule that flexion does not become complete until the head



encounters the resistance of the pelvic floor." Charpentier evidently does not mean that the resistance of the perineal muscles causes this flexion, because, as I shall show later, he recognizes what I have already stated, that the flexion precedes the contact of the bregma with the perineum. If, by resistance of the pelvic floor, he refers to the resistance of the coccyx, he then acknowledges the function of this bone.

[1] "Cyclopedia of Obstetrics and Gynecology," Wm. Wood & Co., 1887, Vol. I., p. 349.

Tarnier[1] also states "that the movement of flexion is, at this juncture, at its utmost limit," but he explains it by saying that, while "the occiput is beneath the pubic arch, all the soft parts which make up the perineum press the anterior part of the head against which they are applied upward and backward."

The same answer applies here; the soft parts which make up the perineum are *not* applied against the anterior part of the head until the coccyx is pressed back and extension is commencing. Flexion at the inferior strait (see cut) precedes contact with the perineum. I am gratified to find that Charpentier[2] supports this statement. He says: "After its rotation, the occiput is not suddenly but progressively liberated, and it is not brought into close contact with the perineum until it is completely freed. Until that time it remains at a certain distance from the perineum, and if we introduce the finger posteriorly, we feel that the head is retained behind by its frontal eminences, on the sides by the biparietal eminences, and that there is a certain space between the perineum and the bregmatic region. In order that the bregma may be brought into close contact with the perineum, the occiput must be liberated from under the symphysis, and the bregma must descend, which it cannot do at this moment unless the head becomes extended."

This statement also furnishes a key to the former quotation from Charpentier that flexion becomes complete only after "the head encounters the resistance of the pelvic floor." It is not, according to him, the resistance of the coccyx which retains the head behind, but the opposition to the passage of the frontal and biparietal eminences.

The reasons for attributing it to the former have already been given at length. Now let us look at it with Charpentier's spectacles—"the head is retained behind by its frontal eminences, on the sides by the biparietal eminences."

Now, in the position of the head as we are considering it, the frontal eminences are still above the inferior strait and in the hollow formed by the receding curve of the sacrum—a location offering little resistance to the passage of the brow; and, on the other hand, the distance between the biparietal eminences is from three and one-half to three and three-fourths inches, while

[1] Cazeaux and Tarnier, "Theory and Practice of Obstetrics," Philadelphia, 1884, p. 321.

[2] Ibid., p. 352.

the length of the transverse diameter of the pelvic outlet is four and one-fourth inches.

Comparing the diameters of the fetal head with those of the pelvic outlet, we find ample room in all directions except one—the antero-posterior or coccy-pubic. But here a diameter of three and three-fourths inches is capable of being increased to four and one-half or five inches by recession of the coccyx; the force expended in pushing back the bone, however, retains the bregma above until flexion is complete.

Leishman[1] describes accurately flexion at the inferior strait, but instead of looking upon it as a normal movement, he considers it exceptional. He says: "If the pelvis is at all under the average in point of size, the frontal region is arrested at the apex of the sacrum, and the occipital end of the lever is again driven downwards, so as to press upon and distend the perineum. If, however, the parts be ample, and the perineum not unduly resistant, this does not occur, and the whole bulk of the head follows the curve of the sacrum at every point, obviously attempting to effect an exit immediately under the pubic arch."

The curve of the sacrum to which he refers is the lower portion, *i. e.*, in a direction downwards and forwards.

It is a movement which is the resultant of the force of the tissues of the floor of the pelvis and that from the uterine and abdominal muscles, and the direction is downwards and forwards. Authors generally describe the descent of the occiput in this direction being guided to the vulvar opening by the perineum.

There are several reasons why this is incorrect. In the first place, downwards and forwards is the direction of the movement of extension, while, as we have seen, the occiput passes behind the symphysis by one of flexion—downwards and backwards (line *a b*).

Again, it is only after this movement has taken place that the perineal muscles are called into play, and it is then that the reflected force of Solayres gives birth to the head by "obviously attempting to effect an exit immediately under the pubic arch."

Leishman[2] once more refers directly to the movement of flexion at the inferior strait. He says: "The oscillations which the head in its course undergoes on its transverse axis are, first,

[1] "A System of Midwifery," Philadelphia, 1875, p. 296.
[2] Ibid., p. 297.

flexion; then partial extension prior to rotation; *then flexion, if the forehead be arrested at the apex of the sacrum;* and finally, the movement of exaggerated extension, which is only completed with the birth of the head."

I have italicized the above words because they represent exactly what is my view of the mechanism in all cases of normal labor with occiput anterior. What I look upon as a distinct and necessary stage, Leishman speaks of as an occasional movement occurring, as he has said, when the pelvis is under the average size. So far, we have considered only the function of the coccyx in occipito-anterior positions, or such that have rotated into that position at the inferior strait.

The same principle, however, is carried out in all cases, the coccyx retarding the end of the lever situated posteriorly until the opposite end slips down and becomes fixed at the symphysis.

In some instances, consequently, the movement will be the opposite of flexion at the inferior strait, as in face presentations with chin forwards. The posterior end of the lever is kept up until *extension* forces the chin under the symphysis.